

Adventures with Jukeboxes, Part 2
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In a previous article we described our frustration attempting to evaluate the Kubik CD240M Compact Disk Changer. This is a follow up to that article and a summary of our experiences with a related technology, magneto-optic jukeboxes.

Kubik CD Jukebox

To recap, we received the first jukebox in October but it was dead on arrival due to shipping damage to the CD-ROM drives. It was replaced with another jukebox in November, which behaved sporadically through several months of tests. This unit was returned to the vendor in April for 'rejuvenation' and shipped back to us in May. After continuing difficulties the vendor sent a technician to our lab, who spent an entire day working on the device. He kept repeating that he had never seen a unit damaged as badly as ours, indicating that shipping problems were the cause of nearly all our problems. At the same time we were dealing with a vendor Advanced Mechatronics Services which has developed a catalog program and Application Program Interface (API) software for the Kubik jukebox on UNIX platforms. They indicated that our problems with both the SCSI bus and caddies had not been experienced in any of their testing.

Since the overhaul, all mechanical and SCSI problems with the device have disappeared. We initiated our stress tests, doing 1000 loads, 964 loads and 999 loads on successive days. To really give the carousel a workout, the loads are done to slots on the farside of the carousel each time, so the carousel is turning its maximum amount at all times.

Based on the success of these tests we agreed to return the evaluation unit and purchase a new Kubik jukebox, which will be hand-delivered to our lab, not shipped. We are also beginning development of a daemon server for the UNIX host which will serve any client which wishes to access the jukebox. This will allow us to access the disks from a variety of different user-interfaces.

Kodak CD Jukebox

Kodak is preparing to market the Professional PDC Compact Disk Jukebox 1000. This is the jukebox developed by the German firm, NSM, with a single Toshiba XM-3401 double-speed CD-ROM reader. The jukebox will sell for \$8K and will be marketed with image cataloging and retrieval applications for Macintosh and PC platforms. No UNIX-based access software is available at this time. Kodak will provide an evaluation unit to the Data Distribution Laboratory in late July.

Magneto-Optic Jukeboxes

In FY93 the Data Distribution Lab received grants from JPL's Equipment and Instrumentation Committee for two jukebox storage systems. The first system is a 50 gigabyte HP jukebox currently being tested by the Mars Observer project in support of CD volume production by the Data Archive Team. The second grant was to purchase a 10 gigabyte magneto-optic jukebox to provide interim storage space for premastered CD image files within the DDL. These files take up 680 megabytes each and it would be beneficial if they could be kept around for a week or so after a disk is made. Unfortunately, due to disk space shortage, these image files must generally be deleted or copied to tape within hours so that other processes can use the hard disk space. Copying to tape takes more than an hour and requires that several manual procedures be performed. It was felt that a magneto-optic jukebox could be used to back-up these files for a few days until initial testing of the write-once disks had been performed.

Though four vendors initially proposed to deliver evaluation units, only two vendors, Avenet and Alphasatronics actually delivered. We were dismayed to find that the 600 megabyte platters formatted down to about 280 usable megabytes per side. This required that 3 platters be chained together to create a virtual volume big enough to hold a CD image file. The tests to be performed included moving various sized files across the network to the jukebox host and attempting a full image copy to the jukebox system. One of our first experiences was a bad piece of media in the first box of 10 magneto-optic disks. There were no indications that the problem was media related, and we had to contact the vendor for a diagnosis. *[Note: As a comparison, we encountered only 1 bad CD-Recordable media in the first 800 disks we procured.]*

In general, our throughput tests for both jukeboxes averaged in the 200 to 300 kilobyte per second range. Results were similar whether the copies were from local hard disks or across our local area network. A key problem was discovered in using the volume spanning capabilities of these devices. Because these jukeboxes use only one read/write unit there can be a great deal of contention in loading the constituent volumes of a multi-volume set. In some cases the file information on one volume of a set may have to be updated while another volume of the set is being recorded, resulting in substantial disk swapping. Our throughput tests of CD-ROM sized test files (680 megabytes) took over four hours on both jukeboxes, an overall throughput rate of less than 40 kilobytes per second.

Obviously these devices will not help to solve the DDL data storage problem. There are now double-density drives and media with a formatted capacity approaching 600 megabytes per side. If one were to use a jukebox with two read/write units and high density media, a fairly efficient jukebox could be developed. However, we have decided that it will be most useful to use the grant funds to purchase an additional 10 gigabytes of hard disk.

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Avnet (U.S. Design Jukebox); Tom Ressler; (310)-787-4113

Kubik Technologies; Lyle Kerr; 604-273-0400.

Kubik Enterprises, Inc.; Laslo Sipos; 408-867-7969.

Advanced Mechtronics Services, Parris Bluford; 8-713-460-5544

Eastman Kodak Corp., Cliff Heckman, 716-253-9196

**Media Study Underway
Mike Martin**

The Data Distribution Laboratory is currently leading a multi-agency federal evaluation of CD recordable media. This is a follow on to a preliminary CD-ROM evaluation conducted in FY92 and published in the Information System Newsletter. It is extremely important that we understand the characteristics of this new media, since plummeting prices (now \$18 per disk) and longevity (probably 50 years, minimum) make it an attractive archive media for federal agencies. The Planetary Data System and Mars Observer Project will be recording several thousand archival volumes in the next two years.

Each CD recordable media vendor (TDK, Mitsui, Kodak, Tayio Yuden, Ricoh, 3M, Verbatim) has submitted 30 samples of both 63 minute and 74 minute media. The media will be recorded by the DDL on a variety of recorders at different recording speeds. The media will then be sent to three agencies, the National Institute of Standards and Technology (NIST), National Technical Information Service (NTIS) and the Naval Air Warfare Center (NAWC) for testing on CD-evaluation systems. After the preliminary testing a portion of the media will be returned to the DDL for testing on a variety of CD readers. The bulk of the media will be delivered to NIST and to the National Media Laboratory for ongoing environmental testing. The results will include a comparison of error rates between different vendors, and different media batches from a single vendor; different error rates between 63 and 74 minute media; and error rates related to record speed. A second set of results will compare differences in test results on the same disks by different test machines, especially the Design Science Analyzer versus the CD-Cats machine. We are also eager to compare error rates between single and double speed readers, since we have seen some incompatibilities with new double-speed readers and recordable media. The test will help us understand the importance of many of the parameters measured by test devices, and see exactly how they effect disk performance and longevity. The first set of disks have been shipped to participants and it is planned that preliminary results of these studies will be published in the Information Systems Newsletter and SIGCAT Newsletter in the fall.